

Quotient Rule

Use the quotient rule to find $Q'(x)$ when

$$Q(x) = \frac{N(x)}{D(x)}$$

$$Q'(x) = \frac{N'(x) \cdot D(x) - N(x) \cdot D'(x)}{[D(x)]^2}$$

$$\text{ex) } y = \frac{x^2}{5x^2-1}$$

$$y' = \frac{2x(5x^2-1) - x^2(10x)}{(5x^2-1)^2}$$

$$= \frac{10x^3 - 2x - 10x^3}{(5x^2-1)^2}$$

$$= \frac{-2x}{(5x^2-1)^2}$$

ex) Find y' for $y = \frac{(x^2 + x + 1)}{(x^2 - x - 1)}$

$$y' = \frac{(2x+1)(x^2-x-1) - (2x-1)(x^2+x+1)}{(x^2-x-1)^2}$$

$$= \frac{\cancel{2x^3} - \cancel{2x^2} - \cancel{2x} + \cancel{x^2} - \cancel{x} - 1 - (\cancel{2x^3} + \cancel{2x^2} + \cancel{2x} - \cancel{x^2} - \cancel{x} - 1)}{(x^2-x-1)^2}$$

$$= \frac{-2x^2 - 4x}{(x^2-x-1)^2} \rightarrow \frac{-2x(x+2)}{(x^2-x-1)^2}$$

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MATH 8:

ex) Find $\frac{dy}{dx}$ for $y = \frac{(2x+1)^3}{(3x^2-6)^4}$

$$\frac{dy}{dx} = \frac{3(2x+1)^2(2)(3x^2-6)^4 - (2x+1)^3(4(3x^2-6)^3(6x))}{((3x^2-6)^4)^2}$$

$$= \frac{6(2x+1)^2(3x^2-6)^4 - 24x(2x+1)^3(3x^2-6)^3}{(3x^2-6)^8}$$

$$= \frac{6(2x+1)^2(3x^2-6) - 24x(2x+1)^3}{(3x^2-6)^5}$$

ex) Differentiate $y = \frac{(2x+1)^3(2x)}{\sqrt{x^2+5x}} \rightarrow y = \frac{(2x+1)^3(2x)}{(x^2+5x)^{1/2}}$

$$y' = \frac{(3(2x+1)^2(2)(2x) + (2x+1)^3(2))(\sqrt{x^2+5x}) - (2x+1)^3(2x)\left(\frac{1}{2}(x^2+5x)^{-1/2}(2x+5)\right)}{(\sqrt{x^2+5x})^2}$$

$$y' = \frac{(12x(2x+1)^2 + 2(2x+1)^3)(\sqrt{x^2+5x}) - (x(2x+1)^3)(x^2+5x)^{-1/2}(2x+5)}{x^2+5x}$$

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